Level 0 Trigger Algorithms and Capabilities

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Trigger Detectors

- CTB –no mip conversion
- ZDC –same as before
- TOF –not for AuAu
- BBC –small/large tiles; same
- BEMC –new modules
- EEMC –all modules
- FPD - full set

Bit list so far

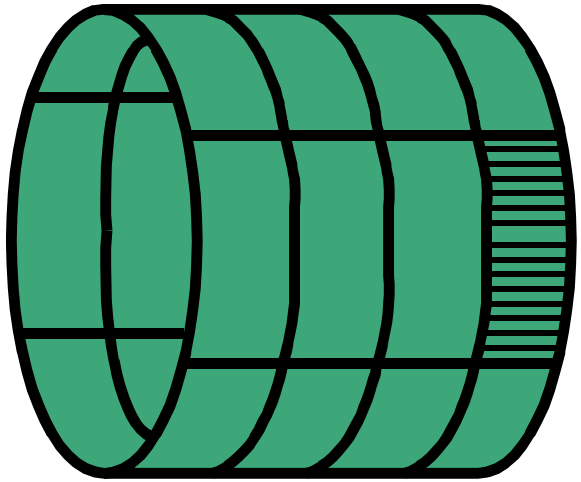
Central Trigger Barrel

Base Algorithm

Central Multiplicity

$$CTB_{Mult} = \sum_{240\,Slats} ADC > th0,1,2$$

n*RHIC crossings dead time per slat (f.k.a.k.b.)



Topology Trigger

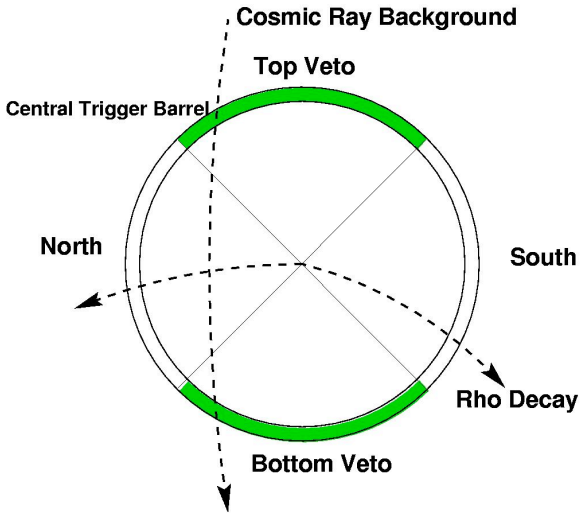
16 phi*eta = 1.5 * 0.5 pixels

Trigger on 1-3 mips in opposite pixels, eventual veto top and bottom, overflows, out of time hits

New in 2004: no Mip conversion

Least Significant ADC bit in each 8bit channel is timing bit,

maintained through ADC sum (+1)



Zero Degree Calorimeter

$$ZDC_{E/W} = ADC > th0/th1 * deadtime$$
$$\& \min < TAC < \max$$

- Main Minbias Trigger in AuAu
- n*RHIC crossings dead time (10)
- ADC>5
- Second threshold in scalers
- Vertex cut by TAC timing window 25<tac<225

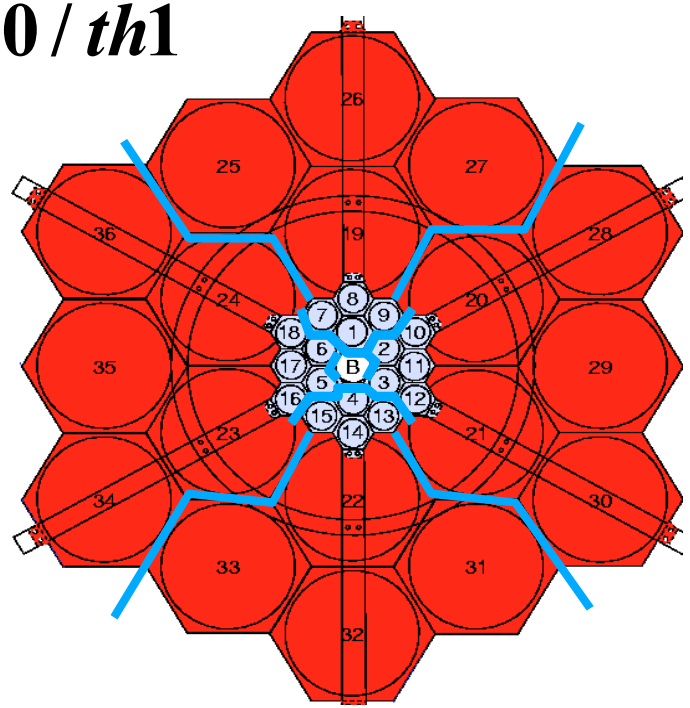
Beam-Beam Counter

- Large and Small tiles treated separately
- 4 Quadrants T/B/N/S
- Small tiles sub-divide in inner and outer ring
- 2 < eta < 4.5

Large Tile BBC

$$BBC_{\text{Large E/W}} = \prod_{8\,PMT} ADC > th0 / th1$$

- Used as veto for UPC
- two thresholds on ADC sum separately East/West -> Scalers
- th0+th1 scalers
- Quadrant hit map available



Small Tile BBC

- Minimum bias trigger (coincidence)
- Vertex determination (timing)
- Luminosity monitor via scalers

16 channels East/West

- 'Good Hit in a channel':= Leading edge of signal (TAC) within a timing window and ADC above threshold

$$\text{Good Hit} = ADC > th0 \;\&\; \min < TAC < \max$$

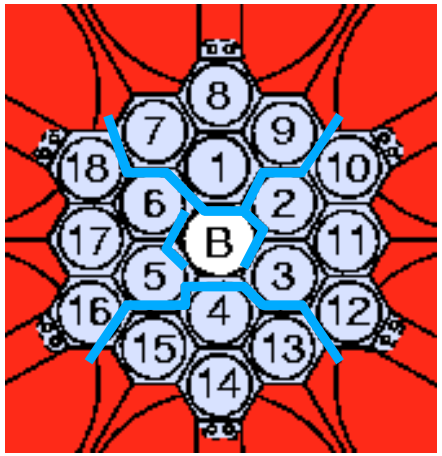
- Only 'good' hits make it into the ADC sum

$$BBC_{\text{small E/W}} = \sum_{16\,PMT} ADC_{\text{good hits}} > th0 \,/\, th1$$

- The fastest signal (above the ADC threshold) in East and West are used for vertex cut

$$TAC = \min < (TACE_{\text{Fast}} \sum TACW_{\text{Fast}}) < \max$$

- In Scalers
  - 'Good hit' map T/B/N/S*East/West
  - Hit-Bits inner/outer ring *E/W
  - Second ADC threshold and timing window

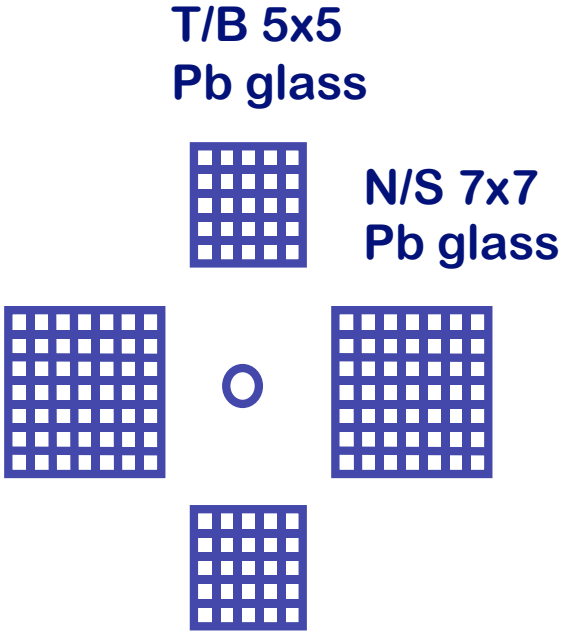


Forward Pion Detector

2004 all 8 modules

Three thresholds per module

$$\sum_{25/47} ADC > th0 / th1 / th2$$



Several possible versions to trigger STAR

- One bit: Any module > th
- Three thresholds coded into two bits
  FPD-E/W –1/2
- Two bits FPD-E/W separately

Code three thresholds
per module into two bits
Thresholds for all 8 FPD
modules in 16 scaler bits

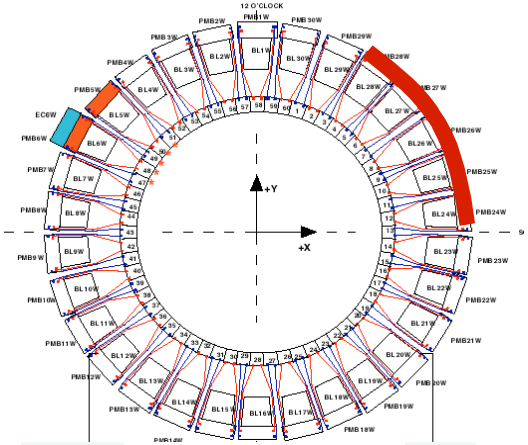
$$ADC < th0 < th1 < th2 = '00'$$

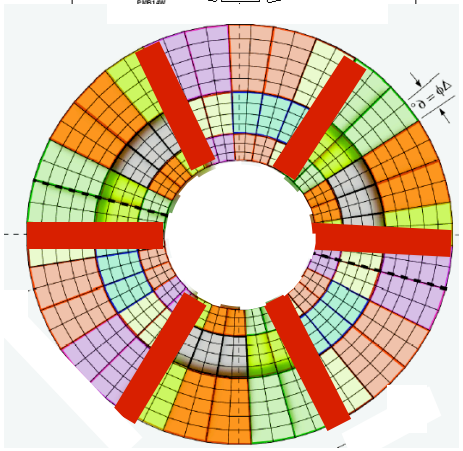
$$th0 < ADC < th1 < th2 = '01'$$

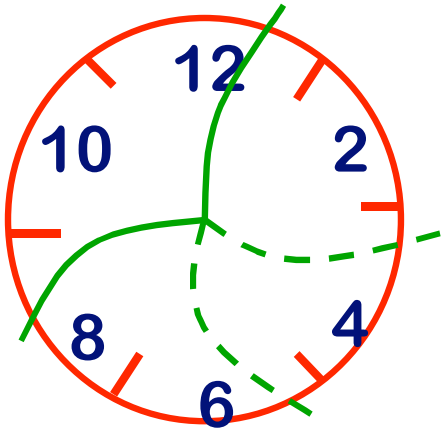
$$th0 < th1 < ADC < th2 = '10'$$

$$th0 < th1 < th2 < ADC = '11'$$

BEMC/EEMC







BEMC

- 15 west modules installed and instrumented, 75 total
- 6+1.5 □□□= 1x1 jet patches

EEMC

- Second half installed
- 720 towers instrumented
- 6 □□□= 1x0.9 jet patches

In level0

4x4 tower trigger patches

6 bit ADC sum

6 bit ADC of 'high'-est tower

Not Used:

jet patch-trigger

Total E_T

High Tower Trigger for High-p_T particles in AuAu

Three thresholds on all 'high-towers' - coded into two bits separately for BEMC and EEMC

$$HT\{0,1\} = \prod_{\text{All High Towers}} ADC_{HT} > th0/th1/th2$$

J/y topology trigger

Trigger Bit List for AuAu 2004

- No major changes
- CTB adc based/no mips
- EEMC/BEMC separate
- No TOF for AuAu
- Definition of MinBias ZDC/BBC
- Save bits by having only BBC/ZDC coincidence in TCU + separate TAC => But Monitoring ?

ZDC E + ZDC W
ZDC <TAC>
BBC E_{small} + BBC W_{small}
BBC <TAC>

	2004 AuAu
0	CTB-1
1	CTB-2
2	ZDC-E
3	ZDC-W
4	ZDC-<TAC>
5	FPD E or W-1
6	FPD E or W-2
7	UPC-BBC-Lg
8	J/psi
9	
10	HT-BEMC-2
11	HT-BEMC-2
12	HT-EEMC-1
13	HT-EEMC-2
14	Blue+Yellow
13	Special